

[54] **EMERGENCY PERCUTANEOUS
TRANS-TRACHEAL HIGH FLOW
OXYGEN CATHETER-TYPE
RESUSCITATOR FOR RESTORATION
OF BREATHING IN NON-BREATHING
PATIENTS**

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[51] Int. Cl. **A62b 7/00**

[58] Field of Search.. 128/145.8, 145.5, 145.6, 145.7,
128/140, 145 R, 142.2, 142.3, 142.4, 351,
305

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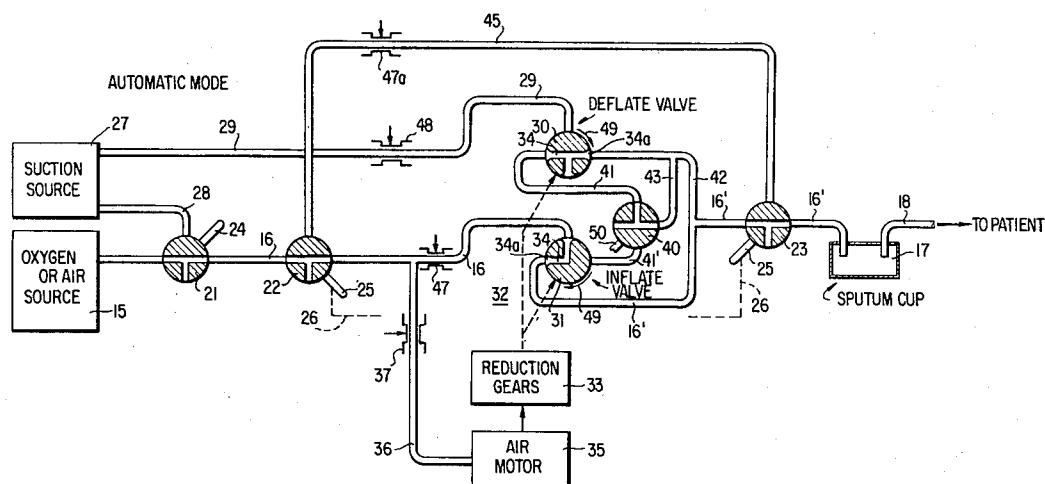
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[57] **ABSTRACT**

An emergency percutaneous trans-tracheal high flow oxygen resuscitator of the catheter type which restores breathing to a non-breathing patient comprising a soft plastic catheter molded from non-pyrogenic thermoplastic material such as polyethylene, polytetrafluorethylene, polypropylene, polycarbonate or other readily sterilized, orientable material which is precurved at its long tubular bottom portion for proper positioning in the median axis of the trachea after straight insertion by means of a cooperating, interiorly positioned hypodermic needle through the crico-thyroid membrane of the patient. The catheter has outwardly projecting wing portions at the top collar portion, the collar accommodating a suction tube or an oxygen tube after the needle is removed. Suction aids in the exhale phase of ventilating the lungs.

Ventilating apparatus is provided for connection to the catheter. The apparatus comprises cyclically operated valve means for selectively connecting the catheter to a source of compressed oxygenated gas or to a source of vacuum for inflation and deflation in the breathing cycle. Other valve means are provided to vary the ratio of inflation and deflation phases during a cycle. The cyclically operated valve means are driven by air motor means powered by the compressed gas. Another set of valves is provided whereby the cyclically operated valve controlled conduit system is bypassed and the catheter may be selectively connected to the oxygenated gas or to the suction source by a manually operated valve in accordance with the requirements of the condition of the patient.

15 Claims, 16 Drawing Figures



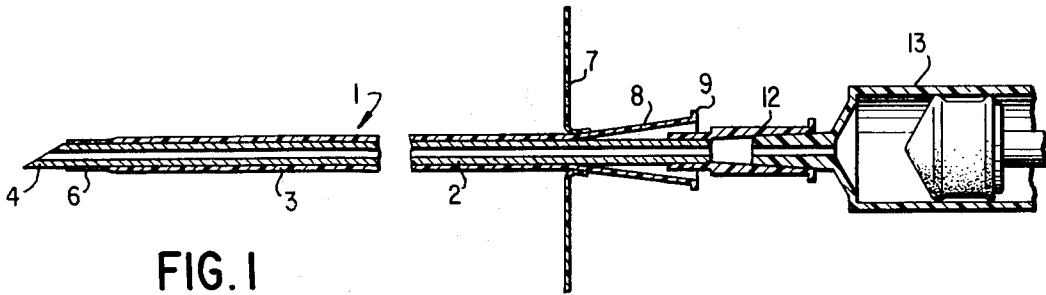


FIG. 1

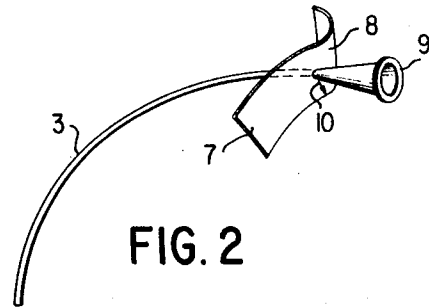


FIG. 2

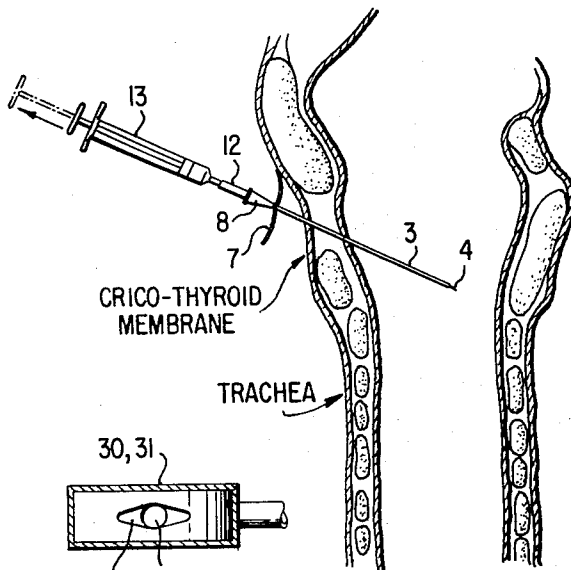


FIG. 3

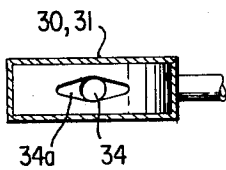


FIG. 8

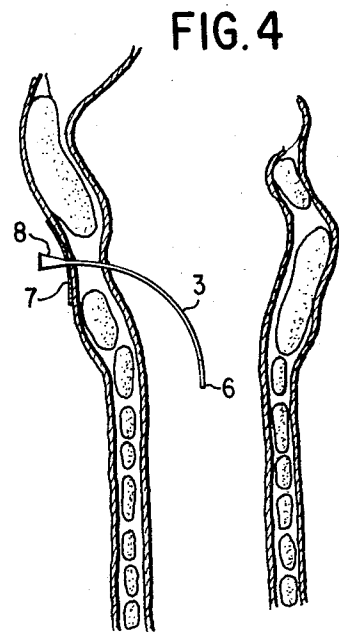


FIG. 4

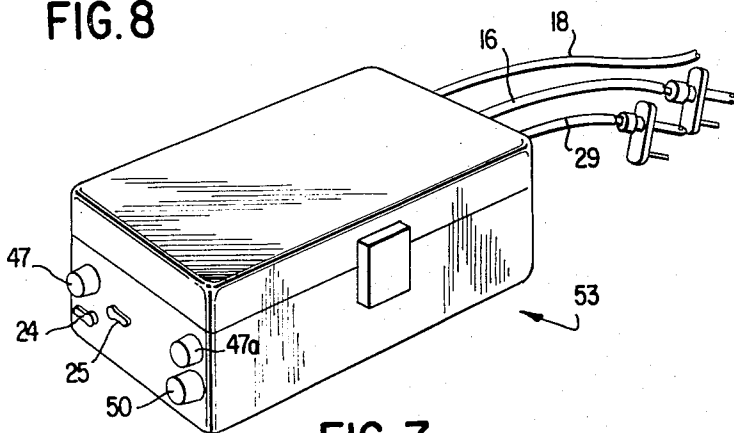


FIG. 7

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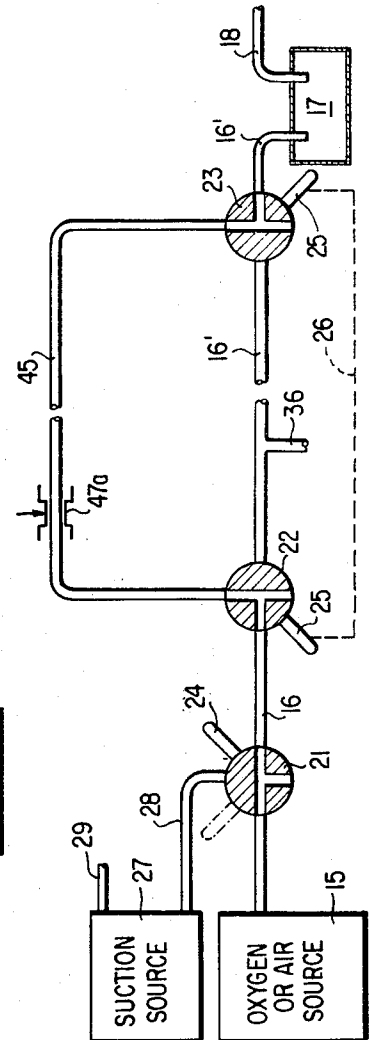
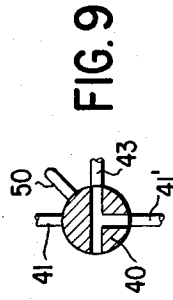
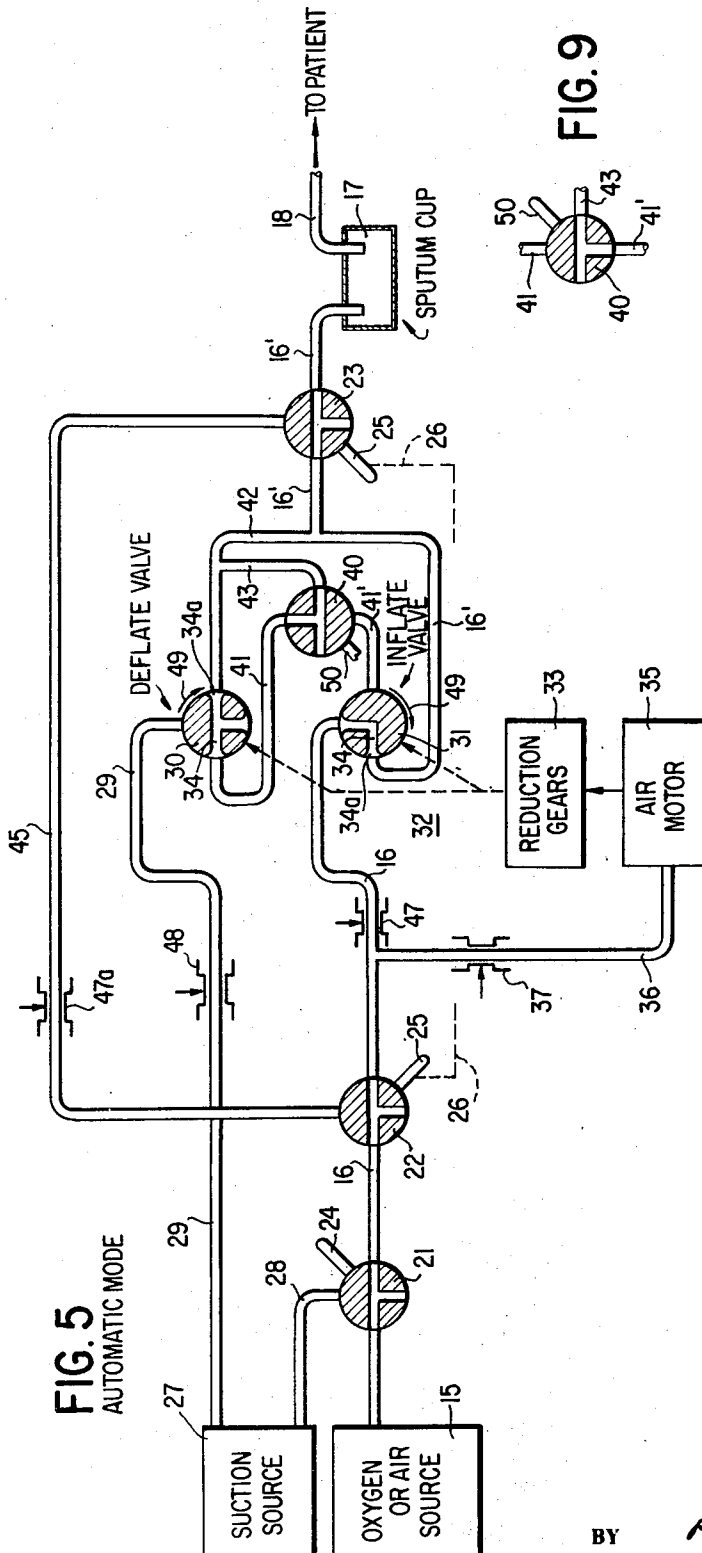
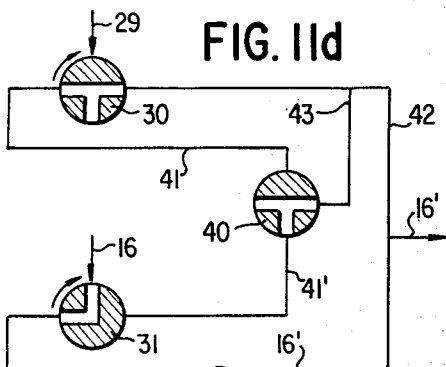
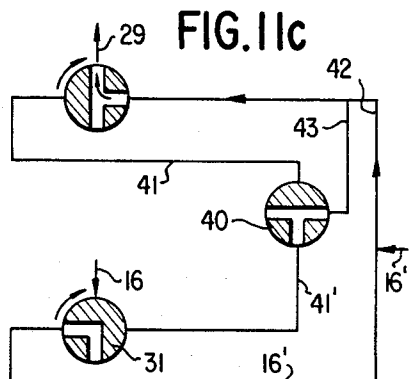
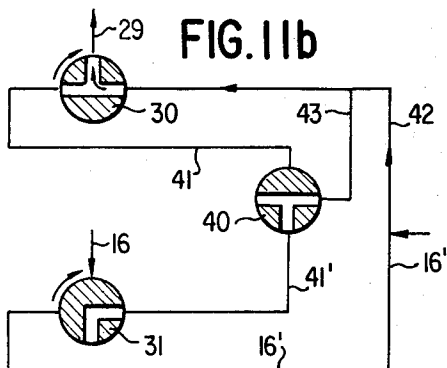
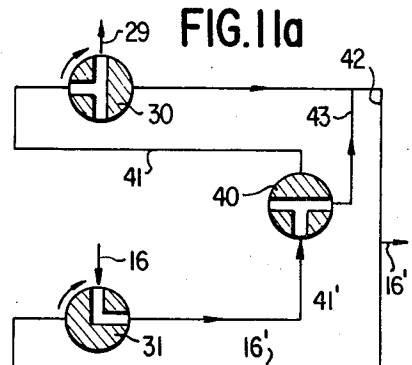
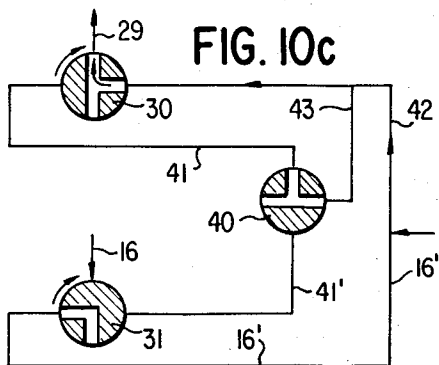
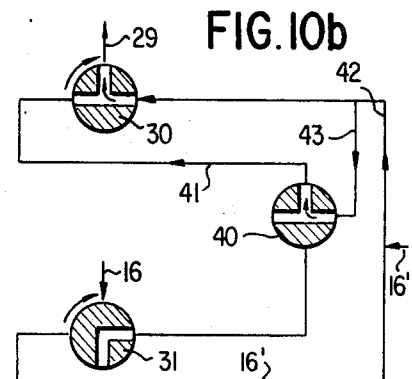
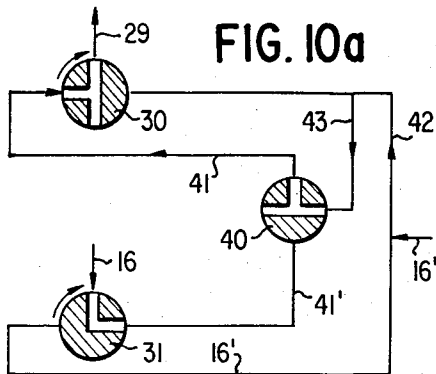


FIG. 6
MANUAL MODE

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EMERGENCY PERCUTANEOUS TRANS-TRACHEAL HIGH FLOW OXYGEN CATHETER-TYPE RESUSCITATOR FOR RESTORATION OF BREATHING IN NON-BREATHING PATIENTS

The present invention relates to an emergency tracheotomy instrument and ventilating apparatus for restoring breathing to non-breathing patients due to tracheal obstructions and pulmonary complications, which is also useful for aiding ventilation for bronchoscopy and during general anesthesia. The ventilator of the invention permits closer control of oxygen inflation to provide adequate ventilation and oxygenation, especially with poor risk patients (heart condition, lung disease, etc.) for whom general anesthesia may be contraindicated but who must have upper abdominal or lower chest surgery. In such surgery, a high spinal or epidural anesthesia is done, but this paralyzes the abdominal and lower chest muscles which assist respiration. The diaphragm is spared because the phrenic nerve originates from the cervical area in embryology and descends, so the diaphragm is able to be voluntarily moved but respirations are depressed.

The instrument of the present invention is an improvement over the prior art instruments represented by the "Tracheotomy Instrument" of U. S. Pat. No. 2,991,767 to Shelden et al. The improved instrument comprises a soft plastic catheter which is precurved at its long tubular bottom portion and an interiorly positioned hypodermic needle. The catheter is provided with a hub portion for connection to suction or vacuum and wings which anchor the instrument after insertion into the trachea. The instrument is inserted into the trachea through the crico-thyroid membrane (after local (novacaine) anesthesia is used to anesthetize the skin, after the needle enters the trachea and novacaine or xylocaine is injected to anesthetize the trachea and tracheo-bronchial tree only in non-comatose patients). The catheter is advanced and the needle removed and the catheter is taped in place. Then the spinal or epidural anesthesia is given and following this, the device is connected to the tracheal catheter and the patient's respirations are assisted. As long as assistance is in rhythm with the patient's own rate, it is tolerated well; oxygen, compressed air or anesthetic gas can be given via this catheter. When the patient is comatose, no anesthesia is needed and if there is an emergency, anesthesia is not needed before insertion. If the patient is not breathing, the ventilator controls the ventilation.

A further object of this invention is to provide a ventilating apparatus comprising a source of oxygenated gas (air, oxygen, etc.) under the catheter selectively to the pressure gas source or suction source. The system provides automatic operation of the valve means by a motor means, preferably driven by the pressure gas, whereby inflation and deflation phases are automatically timed during a breathing cycle. The apparatus also includes a valve whereby the ratio of inflation and deflation phases during a cycle may be varied.

Another object is to provide a valve and conduit system for the above apparatus whereby the cyclically operated system may be bypassed to connect the catheter selectively to the pressure source or to the suction by means of a manually controlled valve. Thus, inflation and deflation phases may be carried out in accordance with the judgment of the operator as he observes the condition of the patient.

A further object is to house the apparatus in a carrying case for portability. The various control valves are provided with handle means extending through suitable openings in the case for selected manual manipulation of the valves. The conduit means to be connected to the catheter, pressure source and suction source also extend from the case and are provided with conventional terminal fittings for easy connection to the catheter and sources.

Further objects and advantages will be apparent from the following description accompanying drawings, wherein:

FIG. 1 is a cross-sectional view of the instrument;

FIG. 2 is a perspective view of the catheter in its free state;

FIG. 3 illustrates the position of the instrument in relation to the trachea;

FIG. 4 illustrates the position of the free catheter in the trachea, the catheter having assumed its normal curved shape;

FIG. 5 is a diagrammatic layout of the conduit, the valve means and the valve operating means of the ventilating apparatus, the valves being in the position for the automatic mode of operation;

FIG. 6 is a partial view of FIG. 5 with the valves in the position for the manual mode of operation;

FIG. 7 is a perspective view of the carrying case housing the several devices of FIG. 5, and illustrating the access to the handle means of the control valves;

FIG. 8 is a top view of a portion of a valve illustrating the configuration of the port of a valve passage;

FIG. 9 illustrates the inflation and deflation phases of the valve in its other position;

FIGS. 10a, 10b and 10c illustrate the positions of the automatic valve means at 90°, 180° and 270°, of rotation, respectively, during a revolution of the cyclically operated valve means, with the inflation and deflation phases of the control valve set for one inflation phase followed by three deflation phases;

FIGS. 11a, 11b and 11c are similar to FIGS. 10a, 10b and 10c, respectively, but with the inflation and deflation phases of the control valve moved to a position to obtain two inflation phases followed by two deflation phases; and

FIG. 11d is similar to FIG. 11c, but showing the valve means in the position of 0° to 360° of rotation.

FIG. 1 illustrates the assembled instrument 1 ready for use. It comprises a hollow needle 2 of suitable gauge which may be a large No. 14 or 16 for the average patient with a soft plastic catheter 3 fitting snugly outside the needle. Point 4 of the needle projects beyond the catheter, the adjacent end 6 of the catheter being shaped to form a gradual reduction in its cross-section to facilitate its insertion in the trachea.

Catheter 3 is molded of a soft plastic to assume a desired curvature suitable for movement within the trachea and at the proper angle. Preferably, the plastic is of the type that incorporates a "memory" therein to resume its molded shape after needle 2 is pulled out therefrom.

The type of soft plastic material which will provide the plastic memory when molded and which is non-pyrogenic has been used in plastic catheters in the prior art and such polymer materials as polyethylene, polytetrafluorethylene, polypropylene, polycarbonate, vinyl chloride resins, vinyl chloride ethylene copolymer

resins and the like may be used, these polymers being readily sterilized and being inert.

A wing formation 7 is secured to catheter 3 near its other end 8 whereby the catheter may be fastened to the skin of the neck of the patient by adhesive tape. This tape may be an integral part of the wing. Also a ribbon may be used to hold it tied around the neck. End 8 terminates in a fitting arrangement whereby the interior of catheter 3 may be connected to a ventilating or resuscitating means, or to medicine administering means. End 8 may be provided with a threaded flange 9 to be screwed to the desired connecting tubing or socket formation means 11 for cooperation with a mating plug on the connecting tubing.

As shown in FIG. 2, it is convenient to mark the device at the wing with an arrow 10 which points in the direction which the precurved soft catheter will assume after the needle is removed from the catheter.

The end of needle 2 is connected by fitting 12 to the discharge end of a syringe device 13. Syringe 13 is used to move air through the inserted needle and catheter to indicate free flow through the trachea and thereby control the movement and location of the needle catheter. The syringe may also be used as a suction device for removing obstructing matter in the trachea. It may also be used for forcing air, medicine or any other desired and necessary fluid into the trachea after the insertion of the catheter.

FIG. 5 diagrammatically illustrates the ventilating or resuscitating system, which system employs oxygenated gas sources such as compressed air, pure oxygen, atmospheric air and a vacuum source. The system comprises a source of gas under pressure 15. This source may be compressed air, pure oxygen or air fortified with a higher percentage of oxygen than normal atmospheric air. The source 15 is connected by conduit means 16 and 16' to a sputum trap 17. From sputum trap 17, a conduit means 18 extends to the patient where it is connected to catheter 3.

Conduit means 16-16' has a series of three-way valves 21, 22 and 23 inserted therein. While the valves are shown as plug valves, such showing is merely for illustration. The valves may be of any type, such as piston valves, poppet valves, disc valves or combinations of other types. Valve 21 has a handle means 24 to move it to a selected position. While valves 22 and 23 are shown diagrammatically as two separate plug means, their passages may be incorporated in a single plug valve device at axially spaced planes. To illustrate the unitary operation of valves 22 and 23, a handle 25 is provided for each valve, the handle being connected for joint movement by a connecting link means 26. Valves 22 and 23 rotate in opposite 90° directions.

Suction or vacuum source 27 may be of any conventional type. It comprises a container connected to a conventional vacuum producing means, such as an air blower, a jet pump, a Venturi device, etc. Conduits 28 and 29 extend from source 27. Conduit 29 is connected to deflate valve means 30, and conduit 28 extends to valve 21.

A two-way valve means 31 is located between conduits 16 and 16' and functions as an inflate valve. For illustrative purposes, valves 30 and 31 are shown as separate valves; however, they work in unison by connecting means 32 which connects them to reduction

gear drive 33. Valves 30 and 31 may be a single valve device with passages to perform the valving functions to be described herebelow. Such valve device may assume any conventional valve configuration, such as piston, poppet, plug, disc, etc. as long as it performs the required valving function. It is preferable that the outlet ports 34a of the several passages 34 in valves 30 and 31 be of a configuration illustrated in FIG. 8. Outlet port 34a is elongated in the direction of valve movement and may be of elliptical or diamond configuration whereby the flow from the valve to the conduits connected thereto is gradually initiated and gradually cut off. The duration of time of fluid flow may be regulated by the length of the longer axis of the port configuration.

Reduction gear device 33 may be driven by any type of motor or mechanical driving means. Preferably, it is driven by fluid motor 35, which may be a conventional air motor, connected by conduit 36 to conduit 16 and thus to source 15. The use of an air motor in lieu of, say, an electric motor permits a self-contained ventilating unit which may be used where no electricity is available, or with a source of compressed gas and never needs a new battery, and its power medium is source 15, which is part of the system.

The speed of motor 35 is regulated by an adjustable throttle valve means 37 inserted in line 36, which valve is diagrammatically illustrated as an adjustable choke valve.

A three way valve 40 is connected by conduit 41 to valve 30 and by a conduit to valve 31. The function of valve 40 is to control the ratio of inflation pulses or phases to deflation phases during a revolution of valves 30-31. It may be termed an inflation and deflation phase control valve. A conduit 42 connects valve 30 to conduit 16'. A branch conduit 43 connects conduit 42 to valve 40. A conduit 45 connects valves 22 and 23.

To control the rate of flow of the oxygenated gas in accordance with the age and size of the patient, throttle or choke valve 47 is inserted in line 16 upstream of valve 31 and a similar valve 47a is inserted in conduit 45. Valve 47 controls the rate of flow when the system operates automatically. Valve 47a controls the rate of flow during manual control of ventilation, as will be described herebelow. The rate of flow of deflation gas from the patient may be controlled by throttle valve 48 inserted in suction line 29.

FIG. 5 illustrates the positions of the several valves in the system for automatic operation of the ventilating means. Air under suitable pressure flows from source 15 through conduits 16 and 16' and through the connecting passages in valves 21, 22, 31 and 23 to sputum cup and from there, by conduit means 18, to catheter 3. Thus, air with the proper, selected percentage of oxygen flows to the patient at a rate controlled by throttle valve 47.

At this phase of the cycle, valve 30 cuts off the several connecting conduits and valve 40 from suction conduit 29.

Valve means 31 and 30 are continuously rotated in the direction of the arrows 49 at the proper desired speed by air motor 35. Assuming the setting of the valves in FIG. 5 to be 0°, at 90° of rotation, as illustrated in FIG. 10a, valve 31 blocks flow from conduit 16 to conduit 16', and valve 30 connects suction source

27 and conduit 29 to conduit 41 and through valve 40 to conduits 43, 42 and 16' and thereby the catheter is connected to the suction source whereby deflation or exhalation of the patient is aided. At 180° of rotation, as illustrated in FIG. 10b, valve 31 still blocks air flow to 16', and valve 30 connects conduit 42 to conduit 29 and therethrough to suction source 27. At 270° of rotation, as illustrated in FIG. 10c, valve 31 still blocks flow to conduit 16' and valve 30 still connects conduit 42 to conduit 29. At 360° of rotation, valves 30 and 31 again assume the positions of FIG. 5 and air is again delivered to the patient to aid in the inhalation phase of breathing.

Thus, a single cycle or rotation of valve means 30 and 31 results in one inflation and three deflation phases. Under certain conditions, it may be desirable to have the same extent of inflation and deflation. Inflation and deflation phases control valve 40 is provided for such operation. If valve 40 is moved by its handle 50 to the position illustrated in FIGS. 9, 11a to 11d, the following connections occur during a single cycle or rotation of valve means 30 and 31. At 0°, illustrated in FIG. 11d, valve 31 connects conduits 16 and 16' and suction conduit 29 is cut off from all connection by valve 30. At 90° or rotation in the direction of arrows 49, illustrated in FIG. 11a, valve 31 disconnects conduits 16 and 16' and connects conduit 16 and 41; and through the passages in valve 40 conduits 41', 43, 42 and 16' are interconnected, for a second inflation phase, while deflation (suction) is blocked. At 180° of rotation, as illustrated in FIG. 11b, conduit 16 is cut off from the other conduits by valve 31. Suction conduit 29 is connected by valve 30 to conduits 42, 16', and 18 to catheter 3 for the deflation phase. At 270° of rotation, as illustrated in FIG. 11c, valve 31 still cuts off flow from conduit 16 and valve 30 connects conduits 29, 42 and 16' for a second deflation phase. At 360° of rotation, the valves assume the position illustrated in FIG. 11d, that is, the 0° position, in which an inflation phase is initiated.

Thus, with valve 40 in the position of FIG. 9, there are two inflation and two deflation phases during a cycle or a revolution of the valve means 30 and 31.

The tapered configurations of outlet ports 34a of the valve passages 34 gradually throttle the flow of the fluid between the valve passages and the conduits during the continuous rotation of valves 30 and 31. The long dimension of the configuration determines the time duration of a phase.

Air motor 35 is always connected to source 15. By manipulating valve 37, the speed of rotation of valve means 30 and 31 may be controlled to vary the phases, of inflation and deflation, per unit-time in accordance with the observed condition of the patient. It is to be understood that the operator of the device is constantly observing the ventilation, blood pressure and other vital conditions of the patient.

Under certain conditions, the patient cannot be subject to the automatic inflation and deflation and the operator must manipulate the inflation and deflation phases in accordance with the abnormal conditions of the patient. FIG. 6 illustrates the valve settings for the manual mode. Valves 21, 22 and 23 are shifted by means of their handles from their positions of FIG. 5 to the positions of FIG. 6. Valves 30 and 31 are rendered

inoperative by shutting off flow to motor 35 by either valve 37 or by a conventional shut off valve located in conduit 36. Thus, in the positions of FIG. 6, valves 22 and 23 interconnect conduit 16 to conduit 16' at sputum cup 17 by means of conduit 45 which bypasses the valve means 30, 31 and 40, and their interconnected conduits.

Valve 21 is then manipulated by the operator from one position to another by handle 24. The position shown in solid lines is the inflate position wherein oxygenated pressure gas, regulated by throttle valve 47a flows from source 15 to conduits 16, 45, 16', 18 to catheter 3. When deflation is desired, valve 21 is moved anticlockwise 90°, to the dotted line positions of handle 24, and the valve passage means. In this deflate position, suction source 27 is connected by the valve means to conduits 16, 45, 16', 18 and catheter 3. The duration of the inflation and deflation phases will be regulated by the operator in accordance with the requirements of the patient which is under his visual observation.

When the patient has reached the state at which automatic ventilation may take place, valves 21 and 22-23 are returned to their "automatic" position (FIG. 5), and motor 35 is started and its speed regulated by throttle valve 37. The rate of flow of gas is controlled by throttle valve 47, since regulation by valve 47a will effect the flow of pressure fluid to motor 35.

The above system is adapted to be placed in a carrying case. FIG. 7 illustrates a preferred embodiment of packaging the system in a case. Case 53 may be of metal or plastic and has a conventional hinged cover. The several conduits may be in the form of rubber or plastic hose means of sufficient strength and rigidity to withstand the pressure and vacuum conditions during operation. Motor 35, gear drive 33 and valves 30 and 31 may be a unitary assembly fastened to the walls or bottom of the case. Handle 24 of valve 21, handle 25 of interconnected valves 22 and 23 and handle 50 of valve 40 protrude from one end of case 53 for manipulation by the operator. It should be understood that FIG. 7 is somewhat diagrammatic and the handles and knobs shown may be members which are mechanically or electrically linked to the valve means within the case to move them from one position to the other position, as described above.

Conduit means 16, 18 and 29 may extend from the other end of the case, or be connected from within the case, each hose having a conventional terminal fitting or plug for easy connection to the catheter and the source of air, oxygen, vacuum, etc.

PROCEDURE OF OPERATION

The article by R. D. Sanders, "Two Ventilating Attachments for Bronchoscopes", Delaware Med. Journ. 39:170 1967, describes an injector device for high flow of oxygen through a bent thin tube, down a bronchoscope to which it attaches at the top, to inflate the lungs of paralyzed, anesthetized patients undergoing bronchoscopy (a 2 foot tube passed between the vocal cords and down into the bronchi in the lungs used for inspection and biopsy). A venturi tube (high pressure air jet) helps to inflate the lungs, but the tube does not go through the skin and only attaches to the outside end of the bronchoscope.

The patient lying on his back, has his neck minimally straightened by lifting up the chin. This makes the trachea more prominent. Then, holding the trachea immobile, needle 2 with soft plastic catheter 3 fitting snugly around the outside of the needle, with arrow 10 upward, is directed down and toward the feet at approximately a 45° angle to the neck, as illustrated in FIG. 3. The needle is inserted through the crico-thyroid membrane (beginning of the trachea approximately one-half inch below the vocal cords) or directly between any easily palpable space between two tracheal cartilage rings. When the syringe 13 which is attached to the needle aspirates air easily, the intratracheal location is assured. Then, the previously stabilized trachea is again held as the catheter is advanced down the trachea its entire length of 2 ½ to 5 inches depending on the patient's size. The needle, which has been kept stable after air is aspirated, is thereafter removed leaving the catheter in place.

When catheter wing or hub 7 reaches the skin needle 2 is withdrawn and wing 7 is taped to the skin of the neck. When the needle is removed, catheter 3 assumes its original curved shape, as illustrated in FIG. 4 to assure a smooth flow of fluid into and out of the trachea passage. Conduit 16 is connected to catheter 3 at end 8. At the option of the operator, conduit 16 may be connected to oxygen or compressed air sources and inflation and deflation may be carried out automatically or manually or a combination of both, depending upon the condition and state of the patient. The number of inflation and deflation phases during a cycle may be selected by valve 40, by manipulating knob 50, if the ventilation is automatic. The rate of flow of the oxygenated gas is controlled by knobs connected to valve 47 and 47a, as indicated in FIG. 7.

If there is not complete or almost complete airway obstruction, the exhalation phase is through the normal tracheal-pharyngeal-oral route and suction is not mandatory, as it is in complete obstruction, although it may be used to remove some secretions and accelerate the exhale phase.

When used in an emergency, this allows immediate respiratory control inserted by any trained person. Because of the soft catheter, there is no continuing trauma to the trachea and other contiguous organs by a sharp needle by transporting or resuscitating the patient. Also, an endotracheal tube can be passed with this soft catheter in place without danger of laceration of this endotracheal tube or of its inflating balloon. The resuscitator is turned off after the endotracheal tube is inserted and the catheter can remain in position for future use, if needed, such as instilling medicines directly into the tracheo-bronchial tree.

When complete obstruction exists, a second catheter or large needle is also inserted to act as a safety valve to insure that the intrathoracic pressure does not continually build up to over 155 mm Hg to begin to compromise venous blood return to the heart.

The valves of the ventilating machine of the invention adjust the number of respirations per minute as well as the tidal volume (volume of gas per each inflation). The statistical average minute volume, i.e., the number of respirations per minute times the tidal volume, is 8.4 liters per minute. In ventilating adults, the tidal volume is increased and the respirations per

minute is decreased, while in children, the opposite is done, e.g., the tidal volume decreased and the respirations increased. Since the volume of gas leakage varies in each situation, the adequacy of ventilation is judged by any or all of the following: the degree of chest expansion, auscultation of the lungs, the color of the patient, and the blood gas values. The valve number 40 shown in FIG. 5 allows one to double the maximum minute volume whenever needed: a larger than usual air leak through the pharynx or stiffer lung compliance as in emphysema, pneumonia, or pulmonary fibrosis.

Blood gas studies were obtained on patients with different disease processes, ages and sizes demonstrated excellent ventilation. Controls were first obtained on other respirators, with an endotracheal tube in place. Then blood gases were obtained after 30 minute equilibration with the apparatus of the present invention. Oxygenation was high and removal of waste was excellent. The blood pH was normal. The blood carbon dioxide remained normal while the oxygen partial pressure was markedly elevated because of the use of 100 percent oxygen. Compressed air or air-oxygen mixtures were found also to be useful.

The chest may be opened for thoracic surgery or open cardiac massage while the pressure device is in place.

Closed or external cardiac massage is compatible with the present apparatus and in addition, helps to deflate the lungs to aid the surgeon who must use cutting or clamping devices within, during critical phases of the operation and frees his hands from massage.

The soft intratracheal catheter, is essential rather than a stiff needle because:

- a. during resuscitation, the neck is mobile and a sharp needle would lacerate the trachea, esophagus and nearby delicate structures,
- b. an endotracheal tube with an occluding balloon can be easily inserted without any risk of laceration by a stiff needle, and
- c. the soft catheter is unequally adapted to remain in place for future use for long periods with absolute safety.

Although a certain preferred embodiment of the invention has been disclosed for purposes of illustration, it will be evident that various changes and modifications may be made therein without departing from the scope and spirit of the invention.

I claim:

1. A patient adaptor means comprising the combination of a ventilating apparatus and a tracheotomy instrument, said tracheotomy instrument including a catheter of plastic material which has a plastic memory and is fabricated in a curved shape, said catheter adapted to fit over the outside of a substantially straight needle and be straightened out by said needle when the needle is pushed through the catheter and penetrates into the trachea to have the catheter therein, said material causing the catheter to resume the original curved shape as a result of said plastic memory within the trachea after the needle is withdrawn therefrom, attachment means secured to said catheter near the outer end where the needle is totally withdrawn after the catheter has been inserted into the trachea, said attachment means adapting the catheter to be taped, tied

or fastened to the neck, and a fluid fitting at said outer end connected to said ventilating apparatus, said ventilating apparatus comprising a pressurized source of oxygenated gas connected to a pressure conduit, a vacuum source connected to a suction conduit and an output conduit connected to said fluid fitting, valve means interconnecting said pressure, suction and output conduits, and passage means in said valve means to connect said pressure conduit to said output conduit and to disconnect said suction conduit from said output conduit to provide an inflation phase in one position and to connect said suction conduit to said output conduit and disconnect said pressure conduit from said output conduit to provide a deflation phase when said valve means are in a second position, said valve means comprising valve members cyclically operated by an air motor mechanically connected thereto, and a throttle valve connected to said motor to regulate the flow of control fluid thereto.

2. A patient adaptor means as claimed in claim 1, wherein the passage means in the valve means are arranged to provide the conduit connections of the deflation phase in at least one more or third position of the valve means during a cycle of movement to thereby obtain an additional deflation phase.

3. A patient adaptor means as claimed in claim 2, wherein said valve members are rotated by said motor and the conduit connections of the deflation phase are repeated at a third and a fourth position during a single revolution of the valve members.

4. A patient adaptor means as claimed in claim 2, wherein the valve means include a valve having a plurality of passages which provide for the conduit interconnections for said first inflation phase and said second and third deflation phases at one setting of the valve, and when said valve is shifted to a second setting, said passages provide the conduit interconnections for a second inflation phase.

5. A patient adaptor means as claimed in claim 1, wherein a bypass conduit is provided to bypass said valve means, first manually controlled valve means to disconnect the output conduit from said motor operated valve means and to connect the output conduit to one end of said bypass conduit, and second manually controlled valve means to selectively connect the other end of the bypass conduit to either the pressure conduit for an inflation phase or to the suction source for a deflation phase.

6. A patient adaptor means as claimed in claim 5, wherein a throttle valve is located in the bypass conduit to control the rate of flow of the pressurized gas.

7. A as claimed in claim 1, wherein a throttle valve is located in the suction conduit to regulate the rate of deflation of the patient.

8. Ventilating apparatus comprising an output conduit for connection to the trachea of a patient requiring inflation and deflation phases comprising a pressurized source of oxygenated gas, a vacuum source, a pressure conduit connected to the pressurized source, a suction

conduit connected to the suction source, valve means interconnecting said pressure, suction and output conduits, motor means mechanically connected to said valve means for cyclically operating said valve means to inflate positions and to deflate positions, a reduction gear train connecting said motor means to said valve means, and passage means in said valve means to connect said pressure conduit to said output conduit and to disconnect said suction conduit from said output conduit to provide an inflation phase in one position and to connect said suction conduit to said output conduit and disconnect said pressure conduit from said output conduit to provide a deflation phase when said valve means are in a second position.

9. Ventilating apparatus as claimed in claim 8, wherein said motor means is an air motor operated by the pressurized gas, and wherein a throttle valve is provided to regulate the flow of pressure fluid to the motor.

10. Ventilating apparatus as claimed in claim 9, wherein the passage means in the valve means are arranged to provide the conduit connections of the deflation phase in at least one more or third position of the valve means during a cycle of movement to thereby obtain an additional deflation phase.

11. Ventilating apparatus as claimed in claim 10, wherein said valve members are rotated by said motor and the conduit connections of the deflation phase are repeated at a third and a fourth position during a single revolution of the valve members.

12. Ventilating apparatus as claimed in claim 10, wherein the valve means include a valve having a plurality of passages which provide for the conduit interconnections for said first inflation phase and said second and third deflation phases at one setting of the valve, and when said valve is shifted to a second setting, said passages provide the conduit interconnections for a second inflation phase.

13. Ventilating apparatus as claimed in claim 9, wherein a bypass conduit is provided to bypass said valve means, first manually controlled valve means to disconnect the output conduit from said motor operated valve means and to connect the output conduit to one end of said bypass conduit, and second manually controlled valve means to selectively connect the other end of the bypass conduit to either the pressure conduit for an inflation phase or to the suction source for a deflation phase.

14. Ventilating apparatus as claimed in claim 13, wherein a throttle valve is located in the bypass conduit to control the rate of flow of the pressurized gas.

15. Ventilating apparatus as claimed in claim 14, wherein all the claimed valve means and valves, and the drive motor and the conduit are housed in a carrier case and wherein the throttle valves and the first and second manually operated valve means are provided with handle means protruding from the case for access thereof to the operator.

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